AIR UNIVERSITY

WATER… BULK OR BOTTLED?

IT'S A BIGGER ISSUE THAN THAT

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Introduction

Providing water on the battlefield is an extremely complex requirement because water supports every facet of combat activity, including troop hydration, feeding and hygiene, construction, vehicles, weapon systems, airplanes, and medical. Water support concepts were studied during the Focused Logistics Wargame (FLOW 2001). The wargame's scenario consisted of four logistics *moves*: humanitarian mission to the Democratic Republic of Congo complicated by an earthquake in Los Angles, an excursion to Korea's show of force in Southwest Asia, and reconstitution with a humanitarian mission to Papua, New Guinea. During these moves, three issues concerning water support surfaced.

The first issue was the growing perception that bottled water is a better quality than bulk water and the impact this perception has on the logistics system: bottled water is expensive and increases lift and disposal requirements. Reportedly, bottled-water contracts cost the Army about $2.00 per gallon as opposed to reverse osmosis water purification unit (ROWPU) water at $0.03 to $0.06 per gallon.[1] Evidence also exists that bottled water sold in the United States "is not necessarily cleaner or safer than most tap water."[2] The second issue arose from the Services' having become more self-sustaining in supporting their own water requirements since they now have alternatives with contractors and host-nation support. Given this increased self-sufficiency, the Army has proposed that its executive agency status be changed to responsibility for providing

backup water support to other Services as required. The third issue was implied: the question of whether or not contract and host-nation support can continue in the future as it does today. Since 1991, US forces have maintained a presence in the Middle East with continued dependence on host-nation infrastructure for water, especially bottled water. Arguably, the impact to the host nation that US forces have on water consumption is minimal since US forces have substantially decreased in numbers since the Gulf War. However, the future could reveal a very different picture. An examination of these issues is critical to ensuring combat water support to American forces in arid regions. The purpose of this article is twofold: to set the stage for the contention that continued reliance on contractors and host-nation support in arid regions is unwise and to provide recommendations for increasing the mobility and independence of water support to American forces in those regions.

Methodology

This article provides a framework to examine these issues by looking at FLOW's worst-case scenario, move three (Southwest Asia). To accurately evaluate water issues from FLOW 2001 and provide useful recommendations, one needs first to explore the history of water support and the future strategic environment for water in Southwest Asia. This examination of the past and present will provide a common frame of reference to use in compiling recommendations.

Brief Historical Perspective of Water Logistics

Water has been a combat weapon or tool since at least 1503.[3] In reference to US experience before 1979, "U. S. forces were historically employed in areas abundant with fresh water sources."[4] Even the North Africa campaign of World War II was conducted within a 75-mile strip along the Mediterranean where water was plentiful. [5] Indeed, the framework leads to the conclusion that continued reliance on contractors and host-nation support for water support is unwise in Southwest Asia and provides several recommendations. In late 1979, following the seizure of the American Embassy in Iran and the Soviet occupation of Afghanistan, there were serious concerns over threats to US interests in the Middle East. In response, the Rapid Deployment Joint Task Force (RDJTF) was organized, and a tanker carrying 9 million gallons of water was prepositioned.

However, there was no system designed to distribute the water to forces in the field, so the RDJTF asked the Office of the Joint Chiefs of Staff (JCS) to address water-support issues. The Chairman of the JCS requested that the Defense Science Board (DSB) study the problems of water support for US forces in arid regions. In September 1980, the Secretary of Defense named the Army the executive agent for land-based water resources. The Army established the Water Resources Management Office (WRMO), which developed a systems approach to the problem by breaking it down into seven components: detection, production, treatment, distribution, storage, cooling, and consumption. WRMO's accomplishment was getting all the Services to agree to a consumption rate of 20 gallons per man, per day (gmd) for joint operations.[6]

Water Doctrine Development

The DSB's report, released to the Chairman of the JCS in October 1981, contained 23 major conclusions and 24 major recommendations. The DSB validated the previously agreed-upon 20 gmd by looking at Egyptian (Soviet- influenced) and Israeli water doctrine during the 1967 and 1973 Egyptian-Israeli wars. The Egyptians had 20,000 heatstroke casualties during 6 days of combat. The Israelis had few heat casualties; they transported bulk water through pipelines with cooling systems at dispensing facilities. Their doctrine directed drinking water at regular intervals, and officers failing to enforce it were subject to court-martial and a mandatory 35-day jail sentence. Other valuable lessons learned from the DSB study were that water needs to be palatable as well as potable, cooled, and possibly flavored as an inducement to drinking it.[7]

Initial US water doctrine was published by the Army Training and Doctrine Command Pamphlet 525-11, and from 1981 to 1983, each Service developed its own funding initiatives. Procurement timetables were forecasted through 1989, with the Army purchasing most of the water systems. Acquisition centered on developing the capability of making water with ROWPU 600-gallon-per-hour to 150,000-gallon-per-hour barges and tactical piping and storage distribution systems.[8] In 1984, the Air Force Logistics Management Center initiated a study that evolved JCS planning factors to 50.1 gmd for arid environments and 21.5 gmd for all other theaters. Conclusions were validation of consumption factors and "water support research, development, and implementation are (being) effectively accomplished within DOD" and by WRMO.[9]

Gulf War Lessons Learned

In 1990, Iraq invaded Kuwait, and US forces responded. Water-support operations stocked forward locations with bulk potable, ROWPU, and bottled water provided by host-nation support.[10] Post-war analyses focused on several water-support logistics issues. General Norman Schwarzkopf delayed deployment of support personnel to maximize combat forces on the ground,[11] and since most trained water-support personnel were in the Reserves, an additional callup was required.[12] Truce shortages were complicated by the terrain, which hindered movement due to a lack of adequate surface transportation routes.[13] There were also concerns over Saudi Arabia and the United Arab Emirates' discontinuing water supplies to US forces. A working group from water resources management drew up a plan to provide water in such a case. The cost exceeded the price of oil.[14] Finally, the length of time (6 months) for the buildup and negotiating for host-nation support may not be a luxury in the future.[15]

Middle East Water: The Future Strategic Environment

The United Nations (UN) Educational, Scientific, and Cultural Organization reported, "We already consume half the planet's available water resources, and demand will outstrip supply by 2025, when the world's population hits 8.3 billion."[16] The UN Comprehensive Assessment of Freshwater Resources states, "Since 1970, the annual, global, average amount available per person has decreased from 12,900 to 7,600 cubic meters." Furthermore, "even if the world maintained the pace of the 1990s in water supply development, it would not be enough" to offset the sixfold-consumption growth

during this century, “more than twice the rate of population increase, and already a number of regions are chronically water-short.”[17]

Time is Already Running Out for Some Countries

Israel’s water consumption is such that its reserves are not being replenished. “Israel’s national water company recently announced that, at current rates, Israel will have no water reserves by winter 2001.”[18] Jordan is facing an even greater water crisis, producing only 225 cubic meters per annum, far below the 1,000-cubic meter per annum requirement by the World Resources Institute.[19] “Kuwait, Qatar, Bahrain, Saudi Arabia, and the United Arab Emirates are five out of nine countries in the world that have the least per capita water resources,” and Saudi Arabia’s underground water resources will be consumed by 2007.[20] Using UN forecasts, by 2025, the following countries in the Middle East region will be in water crisis, leading to tremendous tensions in this region: Yemen, Bahrain, Kuwait, Israel, United Arab Emirates, Jordan, Libya, Oman, Egypt, Syria, and Iran.

Water: Future Source of Conflicts

“Last year, American intelligence agencies told President Bill Clinton, in a worldwide security forecast, that in 15 years there will be a shortage of water so severe . . . there will be regional wars over it.”[21] Fresh-water resources in the region come mainly from the rivers of the Nile, Euphrates, Tigris, Sind, and the Ganges. Turkey has a $32B program to build 19 hydroelectric plants and 22 dams along the Euphrates, Tigris, and

other rivers. These projects, slated for completion in 2017, will result in a 40-percent reduction in the flow of the Euphrates River, affecting Syria, Israel, and Iraq.[22] Turkey also plans to sell water to Israel, despite Syria's concerns.[23] Iran plans to sell Kuwait water from a 540-kilometer, $2B pipeline from the Karkheh Dam.[24] Tensions are continually rising over the division and control over fresh water in the region and its impact on future development and prosperity.[25] Countries are turning to seawater desalination to offset shortages, but these gains are not as great as they seem to be.

Desalination

As of December 2000, 12,500 desalination plants were producing only 1 percent of the world's drinking water, at an estimated cost of $4 to $5 per cubic meter. It takes approximately 5 years to plan and build a plant, according to the French, who are the leaders in the global market of desalination equipment, expected to grow to $70B by 2020. In essence, desalination may not be timely or cost-effective for many countries facing a water crisis over the next 7 to 24 years. Desalination plants will also be key centers of gravity in future conflicts. During the Gulf War, Saddam Hussein attacked desalination plants in two ways. He ordered his troops to dismantle plants in Kuwait and initiated oil leaks, polluting Persian Gulf waters and damaging Saudi Arabian desalination devices.[26] Middle East water-support systems may not be enough for their own populations in the future, much less large coalition task forces.

Recommendations

Considering the number of changes within the strategic environment and technological advances, six recommendations are proposed.

First, another scientific study, similar to the DSB's, would be prudent. It has been 20 years since DSB released its report concerning water support to American forces in arid regions. The study needs to address the executive agent by clearly defining responsibilities and establishing a funding line, absent in the past. This, together with oversight from the Office of the Secretary of Defense, will put teeth into the program to ensure the executive agent can and does execute the program laid out in DoD Directive 4705.1, *Management of Land-Based Water Resources in Support of Joint Contingency Operations*. The study should develop solutions for the potential asymmetric threats water sources may incur through 2025. For example, water production needs to be more maneuverable and less tied to the coastline. Instead of just prepositioning water in tankers, the tankers themselves should be converted to desalination plants. Mobility would make them less vulnerable to coastline pollution or biological chemicals. It is feasible to place a 1,500-acre-foot-per-year reverse osmosis plant on a tanker to produce 4.89 X 10^8 gallons per year.[27] Its mobility could have other benefits such as dumping of brine in areas suffering from low salinity. In 1998, floods in China affected the salinity of Japanese waters, causing a boom in jellyfish populations that clogged fishing nets.[28] Such a tanker system has potential for multinational burden sharing or privatization. The report should also look at fresh-water production capability on Navy ships and the potential of increasing output in offloading for land uses. Furthermore, exploring options concerning

recycling of wastewater in the field, water farming,[29] and wave-osmosis technologies[30] are critical to future successes.

Second, the force structure for water-support units needs to be examined to ensure US forces can deploy capability quickly. A balance between guard, reserve, active duty, and private sources is paramount ensuring the United States has the right capabilities to meet a broad spectrum of water-support challenges (humanitarian, homeland defense, weapons of mass destruction, disasters, war, and so forth). Keep in mind, there may be privatization opportunities for increases in major operations other than war as the global market for water production develops, materializes, and grows to $70B by 2020. Third, water-distribution systems need to be lighter, more flexible, and maneuverable. New technologies in polymers may be useful for piping, getting rid of weight but maintaining velocity and pressure. Micropump technology also needs more exploration. New systems may have to augment or replace the HNS infrastructure, especially in developing countries. For example, in "Senegal alone, nearly 800 pumping stations are equipped with 62 different types of motors and 67 different kinds of pumps," a logistics nightmare.[31]

Fourth, in the interest of inducing the troops to drink, provision of bottled water or water in similar container sizes should be a continued distribution method in garrison. Historical precedent has demonstrated troops will drink more water if it is cool, palatable, and available.[32] A small focus group of Air War College students consisting of Army, Air Force, and Navy officers addressed this issue. Most ROWPU water no longer has a swimming-pool taste. The consensus was that the problem was not the perceived quality of bottled water but its ease of tactical distribution. It is thought to be far more portable

than 5-gallon cans or mass fillings of canteens at water trailers. Also, any organic vehicle available could be used within the unit to transport it. There was also apprehension about potential sanitation problems concerning high temperatures with canteens and water cans.[33]

Fifth, before making final decisions about use of bulk or bottled water, compare *total* ROWPU cost-production data (personnel costs, reserve callup, need for more bulk field-distribution equipment, and so forth) to contract bottled water costs to ensure an accurate comparison. Further, studies on more portable, container-sized distribution methods; recycling containers; and handling of waste are needed. For example, chipping or grinding and forming plastic bottle waste into a variety of useful theater items like revetments, barriers, tent sidewalls, and flooring could be a solution.

Finally, from a strategic point of view, additional studies on how to resolve existing and coming water shortages in the Middle East are needed to help promote security and stability in this region. The ability of the various actors to share, produce, and control water in the future will determine the balance of power within this region. The best prescription for the future is a preventative one.

Summary

Since 1979, the ability to provide water to American forces has vastly improved, as reflected in the brief historical perspective on the development of water logistics. However, the future points toward a problematic water logistics outlook for American forces without modernization of these capabilities. Examining the Middle East strategic environment indicates the coming of a severe water crisis, when reliance on contractors and host-nation support may be not only unwise but also impossible. Countries within

this region will have difficulty supplying their own populations. Now is the time to act in developing and building new water technologies to keep American forces supplied in arid regions. This is why six recommendations were made here to increase the mobility and independence of water support to American forces in this region. "If the soldier does not have adequate water, his health, combat effectiveness, and ultimately, the success of the mission are jeopardized."[34]

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